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The following notes contain excerpts of the paper *Matos J. and Glaus T. Medical treatment of canine heart failure. EJCAP - Vol. 20 - Issue 2 October 2010.* A comprehensive reference list is provided there.

Heart diseases are relevant clinical problems presented in practice, being estimated to affect around 10% of the dogs seen in first opinion veterinary practices. As "heart disease" or "heart failure" per se do not represent adequate diagnoses that would dictate or justify a specific or even cookbook treatment, as exact a diagnosis as possible should be made before treatment of heart failure is initiated. As an example, heart failure manifested as exercise intolerance combined with ascites may be the consequence of various congenital or acquired heart diseases, e.g. tricuspid valve dysplasia, a large atrial septal defect, pulmonic stenosis, tachycardia-induced dilated cardiomyopathy, pericardial effusion and others; however, as similar as the clinical manifestations of these diseases may be, as dissimilar are the individual treatment strategies. Therefore, a cardiac diagnosis ideally comprises the name of a specific disease from a comprehensive list of congenital and acquired diseases, as well as specific diagnoses of all aspects of the failure, including clinical aspects, i.e. forward failure and / or backward failure and left sided and / or right sided failure, pathophysiological aspects, i.e. systolic failure and / or diastolic failure, and complicating aspects, e.g. supraventricular and / or ventricular arrhythmias.

The two most common acquired canine heart diseases are chronic degenerative mitral valve disease (CMVD) and dilated cardiomyopathy (DCM). These two diseases are the only ones where some randomized evidence concerning treatment has been gathered in canine cardiology. The following will therefore focus on treatment recommendations for CMVD and DCM based on evidence where available and based on logic where not, tailored to the stage of the disease (table). The treatment recommendations assume that not only has a clear diagnosis of CMVD or DCM been reached, but also a clear association between heart disease and presenting signs been established.

Drugs to treat heart failure can be divided into: Diuretics, positive inotropes, vasodilators, antiarrhythmics, drugs affecting remodelling, drugs modifying neuro-endocrine activation, nutraceuticals, symptomatic cough suppressants

Treatment of heart failure depending on the stage,
CHIEF classification of heart failure

Stage A	risk of heart disease present, examples: positive gene test, being KKC predisposed to CMVD or Doberman to DCM
Stage B	heart disease present, asymptomatic
≈ *NYHA Ia*	**B_1** normal cardiac size
≈ *NYHA Ib*	**B_2** enlarged atrium or ventricle
Stage C	heart failure objectively documented, present or past
≈ *NYHA I*	**C_1** presently asymptomatic (stable heart failure)
≈ *NYHA II-III*	**C_2** presently mild to moderate heart failure
≈ *NYHA IVa*	**C_3** presently severe heart failure
Stage D	severe heart failure, resistent to common treatment,
≈ *NYHA IVb*	needs hospitalisation and additional therapeutic measures

Stages A and B

So far, randomized studies with ACE-inhibitors (ACEI) starting in the asymptomatic phase of CMVD could not document a benefit in respect to delaying onset of heart failure. Randomized studies with Pimobendan for CMVD as well as DCM are under way.

Stage C

The first sign of CMVD is cough, which occurs in most instances long before congestive heart failure with pulmonary edema and associated dyspnea develops. Exercise intolerance is not an early sign of CMVD disease, either, and its presence should trigger the search for non-cardiac causes.

Before a coughing dog with a typical murmur of mitral regurgitation is placed on cardiac drugs, the relevance of mitral regurgitation for the cough should be corroborated using radiographs and / or echocardiography. Other causes of cough like tracheal collaps, bronchial collapse, chronic bronchitis or interstitial lung disease should be ruled-out.

Dogs coughing associated with CMVD often times are far away from congestive heart failure and represent a therapeutic challenge. The symptoms in these cases are related to compression of the left mainstem bronchus by an enlarged left atrium and probably to chronic bronchial irritation due to the permanent regurgitant jet. It seems logical to try to reduce the volume of MR in order to decrease the size of the left atrium and bronchial compression, and to reduce the speed of the regurgitant jet. For this purpose, we use amlodipine combined with an ACEI as first approach. The developments of cough and of blood pressure are monitored, and amlodipine is titrated up to around 0.2 mg/kg q24h. If the cough is not clearly suppressed within 10 days, and if there is only moderate left atrial enlargement, dihydrocodein or butorphanole are added to the above drugs as next therapeutic trial. If the cough is not suppressed and there is severe left atrial dilation, furosemide instead of cough suppressants is added to the above treatment. If cough is still present, pimobendan is added. It has to be pointed out that no clinical trial, but only pathophysiological logic are the basis for this approach.
Standard maintenance treatment of dogs with overt heart failure due to CMVD includes furosemide (usual dose and dose intervall of 2 mg/kg q12h titrated up or down to minimal effective dose), pimobendan and an ACEI, even though preliminary data did not show a benefit of this triple therapy compared to the combination of furosemide with only pimobendan. If monetary considerations are an issue, furosemide combined with pimobendan alone as opposed to furosemide combined with an ACEI alone is preferred. If the combination of high doses of furosemide per os (>3 mg/kg q8h p.o.), ACEI (q12h) and pimobendan (0.25 mg/kg q12h) does not control pulmonary congestion or ascites, the administration of furosemide is changed to s.c. and amlodipine is added.
The signs of heart failure in dogs with DCM vary depending on severity of myocardial failure, predominating side of heart failure, etiology of myocardial failure, and presence of arrhythmias. As an example, in tachycardia-induced DCM often right sided congestion predominates. In dogs with tachyarrhythmias, ventricular tachycardia or atrial fibrillation, exercise intolerance and syncope may be present without overt congestion. Therefore, choice of drugs in the individual dog should be done based on its individual problems. Dogs with arrhythmias and decreased contractility but without congestion do not routinely receive diuretics; they are placed on antiarrhythmic drugs based on the exact ECG diagnosis and on pimobendan. Dogs with left sided congestive heart failure are treated like described for CMVD, i.e. furosemid in dose and interval to

effect combined with pimobendan and an ACEI. Dogs with right sided congestive heart failure probably do not adequately intestinally absorb drugs; in these furosemide is given i.v. or s.c. until the ascites is controlled. Extrapolated from human medicine, dogs with DCM may benefit from spironolactone.

Stage D

In fulminant pulmonary edema furosemide may be administered as IV bolus every 2 to 6 hours or as IV CRI (0.6 to 1 mg/kg/h), the latter may be more effective. These dogs may benefit form nitrates, particularly sodium nitroprusside as CRI. Pimobendan may be administered by the i.v. route, if oral medication is not possible. By definition, these dogs need hospital care, and therefore should be referred to a hospital.

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